What is claimed is:

1. A method for optically inspecting a semiconductor wafer, the method comprising:

generating a database consisting of a plurality of interpolation points, each interpolation point providing a mapping between a theoretical optical response characteristic for the semiconductor wafer and a corresponding set of N parameters with N being greater than 2;

focusing a beam of radiation on the semiconductor wafer and measuring the resulting diffraction to generate an empirical optical response characteristic; and

generating an interpolated optical response characteristic to match the empirical spectral response, where the interpolated optical response characteristic is calculated using a reduced multicubic function in which all derivative terms are simple, with the reduced multicubic function being substantially continuous and substantially matching the theoretical optical response characteristic at each interpolation point.

2. A method as recited in claim 1 where the total number of database quantities used to generate the interpolated optical response characteristic is less than 4^N.

3. A method as recited in claim 1 where the total number of database quantities used to generate the interpolated optical response characteristic is $(1+N)2^N$.

4. A method as recited in claim 1 where the derivative terms in the reduced multicubic function are generated as finite difference approximations.

5. A method as recited in claim 1 where the derivative terms in the reduced multicubic function are retrieved from the database.

6. A method of evaluating a sample comprising;

generating a database consisting of a plurality of data points, each point defined by a parameter set consisting of specific parameter values and an associated optical characteristic function value sampled at the particular parameter set;

illuminating the sample with a probe beam and measuring the change induced in the probe beam resulting from the interaction with the sample and generating output signals in response thereto;

comparing the output signals with the points in the database using a fitting algorithm and interpolation model, wherein the interpolation model computes a substantially continuous interpolated optical characteristic function at specific interpolation parameter sets, and wherein the interpolation parameter sets are not limited to, but are computed from, those of the data points in the database, with the interpolated optical characteristic function substantially matching the optical response characteristic at each database point, said comparing being repeated until a best fit parameter set is identified as the measured parameter values of the sample;

where the number of database quantities used for the computation at each interpolation parameter set is less than 4^N, where N is equal to the number of parameters; and

where the interpolation accuracy order is higher than first-order.

7. A method as recited in claim 6 where the total number of database quantities used for the computation at each interpolation parameter set is $(1+N)2^N$.

8. A method for optically inspecting a semiconductor wafer, the method comprising:

focusing a beam of radiation on the semiconductor wafer and measuring the resulting diffraction to generate an empirical optical response characteristic;

interpolating a function ***Y[X]*** to generate a theoretical optical response characteristic, where ***X*** is a vector of ***N*** parameters with ***N*** being greater than 2, the interpolation process comprising:

locating an interpolation cell within a database of interpolation points, where each interpolation point is a mapping between a value for the function ***Y*** and a corresponding vector of ***N*** parameters, the interpolation cell including ***X*** on a dimension-by-dimension basis;

retrieving the interpolation points corresponding to each vertex of the interpolation cell; and

using the retrieved interpolation points to evaluate a reduced multicubic function in which all derivative terms are simple.

9. A method as recited in claim 8 where the derivative terms in the reduced multicubic function are generated as finite difference approximations.

10. A method as recited in claim 9 where the derivative terms in the reduced multicubic function are retrieved from the database.

11. A method for optically inspecting a semiconductor wafer, the method comprising:

generating a database consisting of a plurality of interpolation points, each interpolation point providing a mapping between a theoretical optical response characteristic for the semiconductor wafer and a corresponding set of ***N*** parameters with ***N*** being greater than 2;

focusing a beam of radiation on the semiconductor wafer and measuring the resulting diffraction to generate an empirical optical response characteristic; and

generating an interpolated optical response characteristic to match the empirical spectral response, where the interpolated optical response characteristic is calculated using a polynomial function in which all derivative terms are simple,

with the polynomial function being substantially continuous and substantially matching the theoretical optical response characteristic at each interpolation point.

12. A method as recited in claim 11 where the derivative terms in the reduced multicubic function are generated as finite difference approximations.

13. A method as recited in claim 12 where the derivative terms in the reduced multicubic function are retrieved from the database.